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JUL 14 1965

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Marketing Research
Report No. 718

# CALF SHRINKAGE

## UNDER AUCTION MARKET CONDITIONS

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# PREFACE

The sale of calves is an important source of income to farmers in many areas of the United States. In an average year, farmers sell more than 11 million head of calves, for more than $600 million.

Since most of these calves were sold on the basis of price per hundredweight, total delivered weight is important to farmers and buyers. Shrinkage can be an important factor in total delivered weight. For example, if 50 calves averaging 220 lbs. sell at $24 per hundredweight--and they lose 2.5 percent of their weight during a three-hour stand at the market--then the shrinkage amounts to $66.

Buyers recognize that the amount of shrink varies according to the customs of the market. Calves weighed immediately on arrival at the market shrink more after weighing than calves weighed after standing for several hours. Older calves with feed and water available to them at the market will shrink less than those which don't have feed and water. Many buyers automatically discount prices offered for calves at different markets in order to adjust for such shrinkage differences.

Since the Packers and Stockyards Act is designed to, among other things, assure livestock producers and marketers of accurate scales and accurate weighing, some guidelines are needed on calf shrinkage. This study analyzes some of the more common factors which affect the rate of shrink in calves, and the relative importance of these factors. It is published as a guide for marketing calves, to aid in the more effective administration of the P&S Act, and as a basis for future studies.

Special appreciation is given to the Division of Markets, Virginia Department of Agriculture, for its assistance in conducting this study, and to Richard Hardesty, Manager of Fredericksburg Stock Yard Company, Fredericksburg, Virginia, and Old Dominion Stockyards, Culpeper, Virginia, for use of the yards and scales at these markets.

June 1965

SUMMARY

The distance calves were hauled to market was one of the more important factors affecting their rate of shrink during the first three hours after their arrival at the market. In each one-hour period, the rate of shrink after arrival decreased as the distance hauled increased. This relationship was expected, since more shrinkage would occur during transit.

Arrival weight was relatively important during the second and third periods, but not the fourth period. During the second period, heavier calves lost weight at a greater rate than light calves, but during the third period, the reverse was true. Heavy calves shrink faster initially than light calves, but over an extended period of time at the market, heavy calves maintain a greater proportion of their weight.

As the time at the market increased, grade and breed factors became more important than distance hauled and arrival weight.

There was evidence that better grade calves shrink less at the market than lower grade calves. 1/ Breed characteristics were not significant factors in explaining calf shrinkage, except during the fourth period, and were only of slight importance then. Even if certain characteristics would contribute to significant shrinkage differences between breeds, these characteristics, in all probability, would not be sufficiently developed in calves to cause such a variation.

Temperature was not a significant factor in explaining calf shrinkage during any of the time periods.

## Objective of Study

The objective of this study was to determine the rate of shrink of calves during different time periods at the market, and which factors were most closely related to this shrinkage. Four factors were considered: (1) the distance hauled to the auction market; (2) the weight of calves when marketed; (3) the breed and grade of calves; and (4) the prevailing temperature on the sale day.

## Method of Study

This study was conducted over a one-year period, from September 1962 through August 1963, by sample weighing a cross section of calves at one auction sale each month. During each sale day, 10 calves were selected for the supervised weighing sample. 2/ A total of 120 calves were sampled.

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1/ The negative net regression coefficient for Choice grade factor indicated that Choice calves shrank less than the average shrinkage of all calves. The positive net regression coefficients for Cull and Utility grade factors indicated that calves of this quality had higher shrinkage than the average of all calves.

2/ All weighing was conducted at Culpeper, Virginia, with the exception of the sale day in September 1962. On that day, the weighing was conducted at Fredericksburg, Virginia.

After unloading at the market, the calves were graded by a livestock grader employed by the Virginia Division of Markets, and weighed on the auction market scale to the nearest five pounds (for selling purposes) by the regularly-employed weighmaster. 1/ The scale ticket was issued on this weight; notation was made of the breed, and the consignor was asked how far each calf had been hauled. The calves were immediately moved to another area of the yard where a USDA scale specialist made the first weighing for this study. 2/ Calves were kept off feed and water in pens near the scale for the remaining weighing periods. All test weights were made to the nearest one pound. Each calf was weighed once each hour for four hours following the initial weighing. The prevailing temperature was recorded at the beginning of the weighing period and at the end of the four hours.

## Nature of Data

Forty-one percent of the calves in the total sample were Holstein, 23 percent Angus, 15 percent Hereford, 15 percent white-face crossbreds, and 6 percent Guernsey, Jersey, and Brown Swiss.

Most calves marketed through the auction came from farms located within three to 18 miles of the auction market. The average distance hauled was 10.75 miles (table 1.)

Fifteen percent of the calves graded Choice, 21 percent Good, 26 percent Standard, 26 percent Utility, and 12 percent graded Cull. The calves averaged 220 pounds, but ranged from 161 pounds to 315 pounds. The average time of arrival at the market was 8:54 a.m., and the temperature varied from 16 to 88 degrees Fahrenheit (table 1.)

## Findings

One hour after arrival at the market, the calves had lost an average of 2.65 pounds; after two hours, 4.35 pounds; after three hours, 5.57 pounds; and they had shrunk 6.89 pounds per head after four hours at the market (table 2.) The most important factor in calf shrinkage is the length of time they remain off feed. Additional factors such as weight, grade, breed, temperature, and distance hauled affected shrinkage, but to a smaller degree than time off feed. 3/

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1/ The grading service is available to markets in Virginia on a voluntary basis, at cost.

2/ This scale was similar in make and design to the buying scale. Both scales were tested by the Virginia Weights and Measures Section prior to the study and at two other times during the year, and were found to be accurate on all tests.

3/ The influence of the different factors on the rate of shrink was determined by a linear regression correlation technique. In this procedure, the factors were related to the shrinkage which occurred during each one-hour period in turn. Each time period was considered independently of other time periods.

## First Hour Shrinkage

The calves averaged 1 percent weight loss during the first hour at the market (table 3.) Time of arrival, distance hauled, and grade were relatively more important than other factors considered. These factors accounted for 9 percent of the weight loss. For each additional mile hauled, calves lost 0.015 percent less weight during the first hour, indicating that the greater the distance hauled, the less the calves shrank after arrival at the market (table 4.)

## Second Hour Shrinkage

Calves lost an average of 0.6 percent in weight during the second hour (table 3.) Most of the weight variation was the result of the passage of time, but approximately 10 percent of the shrinkage during this period was dependent upon arrival weight, miles hauled, breed, and grade. 1/ The heavier calves had a greater rate of shrink after two hours at the market than light calves. For each ten pounds increase in arrival weight, there was 0.04 percent increase in the amount of weight loss (table 4.)

## Third Hour Shrinkage

There was an average of about one-half of one percent shrinkage between the second and third reweigh (table 3.) Over 13 percent of the weight loss variation was explained by three factors, arrival weight, breed, and miles hauled. 2/ For each additional ten pounds in arrival weight, shrinkage during this period decreased 0.03 percent (table 4.)

## Fourth Hour Shrinkage

The rate of shrink during the last period also averaged about one-half of one percent (table 3.) Most of the weight variation was due to the time factor. Yet, over 12 percent of the weight loss variation was due to breed and quality factors. This indicates that these factors become more important in explaining shrinkage variation as time off feed increases (table 4.)

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1/ Arrival weight was the only statistically significant factor.

2/ Again, only arrival weight was statistically significant.

Table 1. Average Value of Different Factors Affecting Calf Shrinkage

| Factor | Average Value | Standard Error 1/ |
|---|---|---|
| Distance hauled | 10.75 miles | 7.51 miles |
| Arrival weight | 220.2 pounds | 31.6 pounds |
| Arrival time | 8:54 a.m. | 51 minutes |
| Arrival temperature | 50° F. | 21° F. |

Table 2. Average Shrinkage of Calves after Different Time Intervals

| Time Period | Weight Lost | Proportion of Arrival Weight |
|---|---|---|
| | Pounds | Percent |
| From arrival to end of first hour | 2.65 | 1.0 |
| From arrival to end of second hour | 4.35 | 1.7 |
| From arrival to end of third hour | 5.57 | 2.1 |
| From arrival to end of fourth hour | 6.89 | 2.6 |

Table 3. Rate of Shrinkage During Different Time Periods

| Time Period | Average Shrinkage Rate | Standard Error 1/ |
|---|---|---|
| | Pounds | Percent |
| Between arrival and first hour | 1.00 | 0.61 |
| Between first and second hour | 0.64 | 0.51 |
| Between second and third hour | 0.49 | 0.41 |
| Between third and fourth hour | 0.52 | 0.45 |

1/ Standard error is a measure of the dispersion among individuals in the sample.

Table 4. Factors Affecting the Rate of Shrinkage of Calves Sold at an Auction Market

| Time periods at market and factors having F value over 1 | Net regression coefficient 1/ | Standard error of net regression coefficient 2/ | Beta coefficient 3/ | t value 4/ | Coefficient of determination 5/ | Standard error of estimate 6/ |
|---|---|---|---|---|---|---|
| | Percent shrink | Percent shrink | | | | Percent shrink |
| Between arrival and first reweigh (first time period): | | | | | 0.094 | 0.605 |
| Arrival time | .007 | .003 | .252 | 2.737 | | |
| Miles hauled | - .015 | .007 | - .191 | -2.124 | | |
| Choice grade | - .201 | .156 | - .119 | -1.285 | | |
| Between first and second reweigh (second time period): | | | | | 0.098 | 0.500 |
| Arrival weight | .004 | .001 | .224 | 2.475 | | |
| White-face crossbred | - .211 | .128 | .148 | -1.649 | | |
| Utility grade | .158 | .106 | .137 | 1.494 | | |
| Miles hauled | - .009 | .006 | - .125 | -1.332 | | |
| Between second and third reweigh (third time period): | | | | | 0.134 | 1.066 |
| Arrival weight | - .003 | .001 | - .227 | -2.482 | | |
| Holstein breed | .160 | .083 | .192 | 1.929 | | |
| Angus breed | .131 | .096 | .136 | 1.376 | | |
| Miles hauled | - .006 | .006 | - .108 | -1.055 | | |
| Between third and fourth reweigh (fourth time period): | | | | | 0.124 | .430 |
| Utility grade | .375 | .104 | .367 | 3.611 | | |
| Holstein breed | - .730 | .106 | - .297 | -2.572 | | |
| Cull grade | .379 | .142 | .269 | 2.679 | | |
| White-face crossbred | - .189 | .124 | - .149 | -1.527 | | |
| Jersey, Guernsey, Brown Swiss breeds | - .254 | .179 | - .132 | -1.418 | | |

See footnotes on next page.

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1/ Net regression coefficient shows the average percent increase or decrease in shrinkage which occurs with each increase of a specified unit in the factors affecting shrinkage, i.e., each one pound increase in arrival weight, each additional mile hauled, etc.

2/ The standard error of the net regression coefficient is a measure of the extent to which weight shrinkage may vary from the true value simply due to chance fluctuations of sampling. A standard error which is large, relative to the coefficient, is an indication that limited importance should be attached to the net regression coefficient.

3/ The beta coefficient is a statement of each of the net regression coefficients in units of its own standard error. It is useful for comparisons between factors which have different standard errors.

4/ The t value indicates whether or not the variable (arrival weight, miles hauled, grade, and breed) had a significant effect upon the rate calves lost weight in each one hour time period. For the purpose of this study, a t value exceeding plus or minus 2.000 was considered significant.

5/ The coefficient of determination shows the proportion of the variation in weight shrinkage, during each one hour time period, which was explained by factors indicated. For example, arrival time, miles hauled, and choice grade accounted for 9.4 percent of weight lost during the first hour.

6/ The standard error of estimate term is a measure of the probable accuracy in estimating calf shrink using the factors shown under each time period.

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